NANOTECHNOLOGY: APPLICATION IN FOOD, AGRICULTURE AND ENVIRONMENT (SWS 6932/SWS4932)

3 Credits- Every Spring

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COURSE DESCRIPTION/OBJECTIVES:
Description: Nanotechnology is an emerging field of applied science that engages almost every technical discipline – from chemistry to agriculture – in the study and application of extremely tiny materials with particle sizes ranging from ~1-100 nm. This course will cover the fundamentals of nanoscience and nanotechnology from historical development, concepts and principles to nanomaterial manufacturing and property characterization, and the application of nanotechnology in food science, agriculture and environment.

Objectives (This is a co-taught graduate/undergraduate course):
• To learn the basic concepts, principles, and components of nanotechnology. At the end of the course all students will be able to describe basic theory of nanoscience and nanotechnology.
• To learn about the creation and characterization of nanomaterials. At the end of the course all students will be familiar with methods for characterizing important properties of nanomaterials commonly used in agriculture and the environment.
• To learn the application of nanotechnology in agriculture, food, and environment. At the end of the course all students will be able to apply nanotechnology to solve some problems in the fields of food, agriculture, and environment.
• To learn about toxicology of engineered nanoparticles (EPs) and current methods of assessment. At the end of the course all students will be able to understand potential impact of EPs and conduct simple environmental risk assessment.

DELIVERY METHOD: E-Learning System/Articulate and Audio lectures (with powerpoint presentations and reading materials)

FREQUENCY: Spring semester, every year

TARGET STUDENTS: Graduate /senior undergraduate students who wish to become specialists in food, agriculture, and environment.

CLASS ATTENDANCE: Attendance of chat sessions is mandatory. There is 5% grade for chat room participation.

CHAT ROOM SESSION: Chat room session is scheduled 5-7 PM every Thursday except for public holidays.
GRADING:

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
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<tbody>
<tr>
<td>Homework</td>
<td>30%</td>
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<tr>
<td>Chat room attendance</td>
<td>5%</td>
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<tr>
<td>Mid-term Examination</td>
<td>20% (30% for undergraduate)</td>
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<tr>
<td>Review or research</td>
<td></td>
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<tr>
<td>Paper / presentation</td>
<td>20% (Not required for undergraduate)</td>
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<tr>
<td>Final Examination</td>
<td>25% (35% for undergraduate)</td>
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<tr>
<td>Total</td>
<td>100%</td>
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There will be no make-up homework and exams. Late submission of assignments will result in reduced credit (10% per assignment) if it is not agreed upon in advance.

A 94 – 100%
A- 90 – 93%
B+ 87 – 89%
B 83 – 86%
B- 80 – 82%
C+ 77 – 79%
C 73 – 76%
C- 70 – 72%
D+ 67 – 69%
D 63 – 66%
D- 60 – 62%
E < 60%

ASSIGNMENTS/ EXAMS/PROJECTS: Nanotechnology is one of the rapidly-developing frontiers with application in many fields including food, agriculture /LECTURES and environment. This course involves new concepts, principles, application, and measurements. It is important that the students have a good understanding of the concepts and principles. Therefore, in addition to lectures, the students will be also provided with supplementary course materials to read and homework to do at the end of each chapter. The students are required to submit homework report timely in order to obtain scores. The mid-term examination is designed to check the study progresses of each student so that some adjustment can be made based on student’s performance. For graduate level (SWS 6932), each student is required to conduct an independent nanotechnology project. For this project, students will select one of the nanotechnology application areas (Food processing/preservation, agricultural production/nanofertilizers, soil and water quality, and environment-pollution control/toxicology, etc.), conduct a literature review based on journal articles, book chapters, and/or proceeding papers, discuss the characteristics of the concept/approach, its limitations, and benefits, submit a report, and present results of their independent study.

TEXTBOOK/REFERENCES:

No textbook is required. Reference books, journal articles, and related information links are provided on course website and in disk. Some examples of general readings that support several topics are listed as follows: 

**PREREQUISITES:** General physics and chemistry at a college level

**OFFICE HOURS:** Open for e-mail and phone call at any time or chat room by appointment.

**COURSE CHAPTERS**
Nanotechnology: Application in Agriculture, Food and Environment
Chapter 1 Fundamentals of Nanoscience and Nanotechnology
2 Nanoscale Materials: Definition and Properties
3 Manufacturing and Characterization of Nanoparticles
4 Nanotechnology Application in Agriculture
5 Natural Nanoparticles and Their Role in Soil and Water Quality
6 Nanotechnology Application in Food Sciences
7 Nanotechnology Application in the Environment
8 Environmental Fate and Transport of Engineered Nanoparticles
9 Environmental Toxicology of Engineered Nanoparticles
10 Environmental Regulation of Engineered Nanomaterials
11 Smart Nanoscale Systems for Targeted Delivery of Drugs, Nutrients and Pesticides

<table>
<thead>
<tr>
<th>Week</th>
<th>Topics covered</th>
<th>Lectures/reading materials/assignments</th>
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<tbody>
<tr>
<td>1</td>
<td>Introduction/ historic development and fundamentals of nanoscience and nanotechnology</td>
<td>Lecture 1/Chapter 1 Reading materials Assignment 1</td>
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<tr>
<td>2</td>
<td>Nanoscale materials: definition and properties</td>
<td>Lecture 2/Chapter 2 Reading materials Assignment 2</td>
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<td>Manufacturing and characterization of nanoparticles</td>
<td>Lecture 3/Chapter 3 Reading materials Assignment 3</td>
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<td>4</td>
<td>Nanotechnology application in agriculture I &amp; II</td>
<td>Lectures 4/Chapters 4 Reading materials Assignment 4</td>
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<tr>
<td>5</td>
<td>Natural nanoparticles and their role in soil and water quality</td>
<td>Lecture 5/Chapter 5 Reading materials</td>
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<td>6</td>
<td>Course review</td>
<td>Mid-term exam</td>
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<tr>
<td>7</td>
<td>Spring break</td>
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<tr>
<td>8</td>
<td>Nanotechnology application in food sciences</td>
<td>Lecture 6/Chapter 6 Reading materials Assignment 5</td>
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<tr>
<td>9</td>
<td>Nanotechnology application in the environment</td>
<td>Lecture 7/Chapter 7 Reading materials Assignment 6</td>
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<tr>
<td>10</td>
<td>Environmental fate and transport of engineered nanoparticles</td>
<td>Lecture 8/Chapter 8 Reading materials Assignment 6</td>
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<tr>
<td>11</td>
<td>Environmental toxicology of engineered nanoparticles</td>
<td>Lecture 9/Chapter 9 Reading materials Assignment 8</td>
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<tr>
<td>12</td>
<td>Environmental regulation of engineered nanomaterial</td>
<td>Lecture 10/Chapter 10 Reading materials</td>
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<tr>
<td>13</td>
<td>Smart Nanoscale Systems for Targeted Delivery of Drugs, Nutrients and Pesticides</td>
<td>Lecture 11/Chapter 11 Reading materials</td>
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<tr>
<td>14-15</td>
<td>Course review</td>
<td></td>
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<tr>
<td>16</td>
<td>Final exam</td>
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* Dates for topics or exams are subject to change.

**ACADEMIC HONESTY:** In 1995 the UF student body enacted an [honor code](#) and voluntarily committed itself to the highest standards of honesty and integrity. When students enroll at the university, they commit themselves to the standard drafted and enacted by students. In adopting this honor code, the students of the University of Florida recognize that academic honesty and integrity are fundamental values of the university community. Students who enroll at the university commit to holding themselves and their peers to the high standard of honor required by the honor code. Any individual who becomes aware of a violation of the honor code is bound by honor to take corrective action. The quality of a University of Florida education is dependent upon community acceptance and enforcement of the honor code.

The Honor Pledge: We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity. On all work submitted for credit by students at the university, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment."
The University requires all members of its community to be honest in all endeavors. A fundamental principle is that the whole process of learning and pursuit of knowledge is diminished by cheating, plagiarism and other acts of academic dishonesty. In addition, every dishonest act in the academic environment affects other students adversely, from the skewing of the grading curve to giving unfair advantage for honors or for professional or graduate school admission. Therefore, the University will take severe action against dishonest students.

Similarly, measures will be taken against faculty, staff and administrators who practice dishonest or demeaning behavior. Students should report any condition that facilitates dishonesty to the instructor, department chair, college dean, Student Honor Council, or Student Conduct and Conflict Resolution in the Dean of Students Office. (Source: 2010-2011 Undergraduate Catalog)

It is assumed all work will be completed independently unless the assignment is defined as a group project, in writing by the instructor. This policy will be upheld at all times in this course.

**STUDENT RESPONSIBILITIES:** Students should report any condition that facilitates dishonesty to the instructor, department chair, college dean or Student Honor Court.

More information about student responsibilities are available from the current University catalog, online at: [http://www.registrar.ufl.edu/catalog/policies/students.html](http://www.registrar.ufl.edu/catalog/policies/students.html).

**SOFTWARE USE:** All faculty, staff, and students of the University of Florida are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against university policies and rules, disciplinary action will be taken as appropriate.

**CAMPUS HELPING RESOURCES:** Students experiencing crises or personal problems that interfere with their general well-being are encouraged to utilize the university’s counseling resources. The Counseling & Wellness Center provides confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal problems or lacking clear career or academic goals, which interfere with their academic performance.

- University Counseling & Wellness Center, 3190 Radio Road, 352-392-1575, [www.counseling.ufl.edu/cwc/](http://www.counseling.ufl.edu/cwc/)
  
  Counseling Services  
  Groups and Workshops  
  Outreach and Consultation  
  Self-Help Library  
  Training Programs  
  Community Provider Database  

- Career Resource Center, First Floor JWRU, 392-1601, [www.crc.ufl.edu/](http://www.crc.ufl.edu/)

**STUDENTS WITH DISABILITIES:** The Disability Resource Center coordinates the needed accommodations of students with disabilities. This includes registering disabilities, recommending academic accommodations within the classroom, accessing special adaptive computer equipment,
providing interpretation services and mediating faculty-student disability related issues. Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation.

0001 Reid Hall, 352-392-8565, www.dso.ufl.edu/drc/

STUDENT COMPLAINTS: Each online distance learning program has a process for, and will make every attempt to resolve, student complaints within its academic and administrative departments at the program level. See http://distance.ufl.edu/student-complaints for more details.